MENG 411 CAPSTONE TEAM PROJECT

Eastern Mediterranean University

Faculty of Engineering

Department of Mechanical Engineering

Design Pneumatic System on a Conveyor Jack

Course Coordinator

Assist. Prof. Dr. Mostafa Ranjbar

Project Supervisor

Prof. Dr. Majid Hashemipour

Group of Name

NoFear

Team Members

Ömer Oğuz KESER-071039

Yusuf Çağlar ÖZBEK-071079

Onurcan ONUR-101048

Capstone Team Project Spring 2014-2015

Table of Contents

List of Figures

List of Tables

ABSTRACT

Flexible manufacturing system has gained importance in previous years and it continues development day by day. The important thing in flexible manufacturing is to reduce human label cost, increase operation speed and storable.

In this Project, aim is ; the material which is coming from a conveyor to move through another conveyor carrying with a pneumatic system. First of all, the parts and materials to create an end product material is installed for the transport system. The pallets are moved along the tracks by the system. The routing information to be determined for the product is to be produced and preloaded into the memory of the computer. Automated material handling systems, components from one machine to another, move in the order specified in the machine process plan. The piece completed and the automatic loading / unloading are sent to the station. The parts removed from the pallet and the pallet are loaded by new parts. After all the operations complete, the parts to another station in the material handling system are to be sentmanually.

CHAPTER 1

INTRODUCTION

1.1 SUMMARY OF PROBLEM

Understanding of Flexible Manufacturing Systems (FMS) depends upon the understanding of the concept of flexibility. It is a concept related to adapting quickly and effectively to changes in the market of the production systems. Flexibility, an activity measure in FMS, is the system structure in the design of production systems, organization, system components, material and it is defined as information and energy flow which is an important variable in improving the system in the long run.

1.2 DESCRIPTION AND CHARACTERISTICS OF FLEXIBLE MANUFACTURING SYSTEMS

Adjustments can be defined as the amount required in the mixture of production and the respond quickly to changes in the different types of work stations handling the process in a variety of different part types and demanding simultaneously. However, some of the different perspectives available in the literature can be listed as follows:

- FMS, the different parts and the needs for significant changes and machine down-time products producethe ability of the system.

- FMS has been developed with the aim of a flexible supply-demand flexibility to respond in the market; certain products to customers with the ability to produce at low cost variety, teamwork, empowerment of employees and a system to ensure the continuity of its operations by increasing the competitiveness of enterprises.

1.3 THE CHARACTERISTICS OF FLEXIBLE MANUFACTURING SYSTEMS

-They are used in much of the product types in business

-End products, semi-end goods and raw materials with automatic band can be moved by the material and the carrier

- It is possible to change the production of different partsautomatically when the machine is operating

-They minimize the staff intervention in the production

- They enable to carry out all the operations in the factory quality control from raw material input to the end output design, such as the production of computer-based automation

-They include general-purpose machinery and machine tools which provide convenience the equipment to fragmentise and make minor changes in deadlock conditions and failures.

-They have the group technologyhaving the ability to processthe parts in various sizes.

In general, they are built to be adjusted quickly and intelligentlyas mentioned before.In other words, efficiency and flexibility have been the problemsseen on their traditional production systems increased in recent years and they expanded Computer Integrated Manufacturing (CIM), Flexible Manufacturing Systems,having the ability to respond to a flexible supply-demand on the market, but also to many kinds of specific products to customers.In addition, they have the ability toraise activities in providing cost-effective products, teamwork, the empowerment of employees, and to ensure the sustainability andcompetitivenessof their businesses.

1.4 MAJOR TYPES OF FLEXIBILITY

- **Bench-machine Flexibility :** Systems not facilitating the desired changes in the production of the part type can be made in different processes and benches.
- **Production process-Process Flexibility** :It is possible to use different materials with different techniques to produce the desired products adhering to the machine flexibility.
- **Product Flexibility** : Itis economical and quick modification of a product set or a new product of the production system.
- **Workflow (routing) Flexibility** :It is such as system that directs the disruption or failure to sustain the operation of the parts' routing.
- **Expansion Flexibility** :It is easy to manufacture and it offers a modular format can be enlarged (with the order to increase capacity) related to a measure.
- **Quantity-Volume Flexibility** :It is the manufacturing capacity of the system in different amounts. Its production is economical and determined by the route flexibility.
- **Process Flexibility** : It isassociated with each type of process which is an indication of a part that can not be amended to change the order.
- **Production Flexibility** ; It is the diversity of the number of products and is related to the changes ofits management.
- **Flexibility Movement (dynamic flexibility)** :It is defined as the capacity to make new breakthroughs to respond to the changing market conditions.
- **Status flexibility (static flexibility)** :Market conditions change even though the ability to continue to produceefficiently. The company provides the flexibility to move forward on the basis all these flexibilitiesand so it will have an important role in increasing the competitiveness for the future.

1.5 OBJECTIVE OF THE REPORT

The main objective of this project is to design and integrate a pneumatic jack to two neigbour conveyor systems. Conveyor jack aim is to connect the two conveyors and provide continuity of the line. This upgrade enables the conveyor to shift the product from one line to another one in case of space shortage on one conveyor.

1.6 ORGANIZATION OF THE REPORT

In Chapter 1, the introduction is written, the concept of flexibility and description of flexibile manufacturing system. In Chapter 2, literate rewiew of conveyor process is discussed with previous work on conveyor process wire. In Chapter 3, design and analysis is discussed. In Chapter 4, we discuss about assembly and testing where design of the pneumatic system. In Chapter 5 result and discussion. In Chapter 6 conclusion and future works. The report also include the appendix A logbook, appendix B gant chart, appendix C drawings, apppendix D engineering standart properties and appendix E web site of Project and poster figures and tables.

CHAPTER 2

LITERATURE REVIEW

2.1 HISTORICAL DEVELOPMENT OF PNEUMATIC SYSTEMS

Compressed air is the oldest known types of power transmission people use to increase the physical strength. To be precise, the first known application of compressed air, the Greeks Ktesibios, carried out with compressed air catapult as he did before 2000. Pneumatic, Greek for "breathing" which means "pneuma" is derived from the word. Air pressure or vacuum effect by the operation of machines, tools and pneumatic called the sciences including the properties of the system. A truly pneumatic applications has started after 1950. Previously, only the mining industry, construction industry and rail (air brake) was used. Pneumatic main entrance and spread of the industry in mass production beginning with the need for modernization and automation. Despite initially opposed to ignorance arising from use of the field it increased with each passing day. Today the pneumatic devices in many different industrial applications are preferred.

2.2 Pneumatic System Classification

Pneumatic cylinders, they turn the compressed air energy depending on the linear pushing or pulling motion. A pneumatic cylinder members are, the front and rear covers, cylinder tube and the piston rod.

2.2.1 Single Acting Cylinder

In this type of compressed air cylinder affects one direction. So one orifice for air entrance and exit. Thus operation is achieved only in one direction. The return of the piston rod is provided by a spring or external force (e.g., load weight). Sometimes pulling direction can be made to work by placing the spring piston rod piston side. Release resistance value is selected to push the piston rod quickly enough. Single acting cylinder is shown in Figure 1.

Figure 1: Single acting cylinder

2.2.2 Double Acting Cylinder

This type of cylinder air pressure and the force obtained relative to the piston surface of the piston rod moves in either direction. So that work can be done in two directions. Depending on the surface the effect of pressure on the two sides each force has different values. The cylinder has two inlet and outlet ports. Double acting cylinders as shown in Figure 2 are used particularly when doing business will return in the direction of the piston rod. When air is introduced to the piston side of the piston rod during operation air is discharged on the side of the piston or piston rod side, when the air is discharged to the exhaust air.

Figure 2: Double Acting Cylinder

2.2.3 Padded Type Cylinder

In order to prevent damage that could move by a pulse or heavy masses cylinder stroke end cushioning is made. A cushioning pad before approaching the last stroke closes the hole where the air is freely released. In this case only air is evacuated through an opening that can be very small and is usually set. That can not be quickly discharged air mass trapped between the piston and the cylinder head. The road continues through a return air valve would. Cushioning can be done in one direction or in two directions. Padded type cylinder is shown in Figure 3.

Figure 3: Padded Type Cylinders

2.2.4 Double Piston Cylinders

These cylinders are also available on both sides and embedded in the piston rod. Owing to this prevents lateral loads may occur. Surface on both sides is the same as the forces and speeds obtained are equal. Double piston cylinder is shown in Figure 4.

Figure 4: Double Piston Cylinder

2.3 Improvement of Conveyor Jack:

In this Project two conveyor will working at the same time. When one of the conveyor is full, products transfer to other conveyor with pneumatic system from first conveyor and production will be non stop. Also, when transfer products to another conveyor working area will be increase.

This Project can be improve in future by implementing a barcode reader to distinguish different products on the conveyor. This, enables the system to root the products to the proper station.

2.4 Previous Studies on Conveyor jack :

Old conveyor beld begin to use in 19th century. Firstly, Thomas Robins used conveyor belts for carrying coal, ores and other products in 1901.In 1913 Henry Ford which is owner of Ford Motor company begin to use assembly line for carrying car parts. Hyacinthce Marcel Bocchetti was designed a concept conveyor belts which is 13. 8 km distance in 1957.In 1970 Intralox, a Loisiana based company, registered the first patent for all plastic, modular belting. Conveyor belt is working with computer systems since 1990 to now. Computer systems gained to a lot of advantage in this manufacturing worklife. In this way increase the production limit and speed. Every factories and companyies are using different conveyor systems .

2.5 Latest trend in Conveyor jack

Nowadays in manufacturing and assembly flow lines for instant assembly lines they need to have part differentiation. For different processes and assemblies different parts are needed. The problem of a differentiation is putting the parts on the material handling systems and there is a gap and most of the solution will be solved by utillizing human layber. Some new technologies are avaliable to overcome this problem like barkot reader but there technologies have their own difficulties. In this report a newest technology has been discussed which is RFD system. RFD is a system for identification of parts automotically. In our design system this RFD is implemented to identify differentiant them to go to different cells. For this case to pyneumatic jack or bridge is consider and integrated with RFD as it shown in the picture.

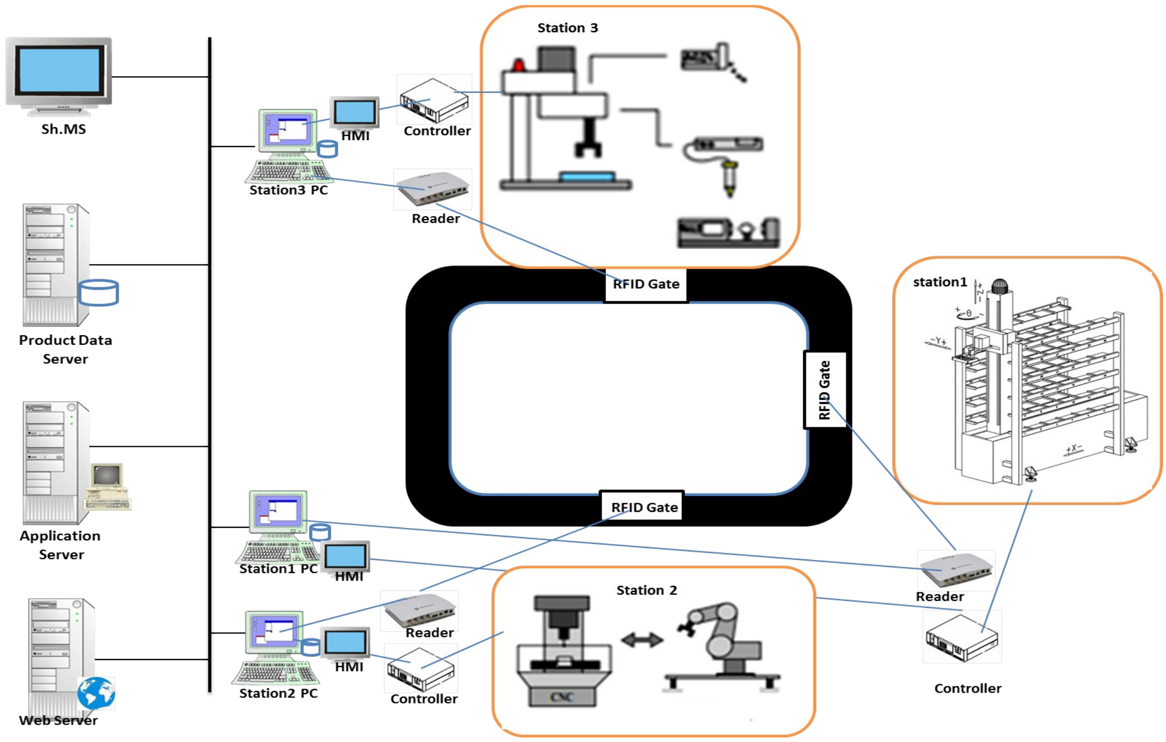


Figure 5: RFID-Based Manufacturing Control System

2.6 Conveyor jack advantages and disadvantages

2.6.1 Advantages

- Circuit elements are simple and inexpensive.
- The compressed air is easy.
- Easily storable.
- Temperature is not against sensitive.
- High operating speed.
- It is easy to overload security.
- Temperature is not against sensitive.

2.6.2 Disadvantages

- The air may be trapped reducing control and precision.
- Air leaks may ocur.
- It May require extra drying and filtering.
- Speed control is difficult.

CHAPTER 3

DESIGN AND ANALYSIS

3.1 Motivation

The design of shorter path with more number of junctions will reduce the makespan during production. This manufacturing cell is build on two conveyors and Four stations. Every station is giving its specific services. All part mounted on pallet are carrying their own scheduling information on their tags. This scheduling information are guiding junctions and blockers toward their actuation. The decision for this actuation is made based on status of accessible stations. Searching for this accessible station, requires a flexible conveying structure for short access.

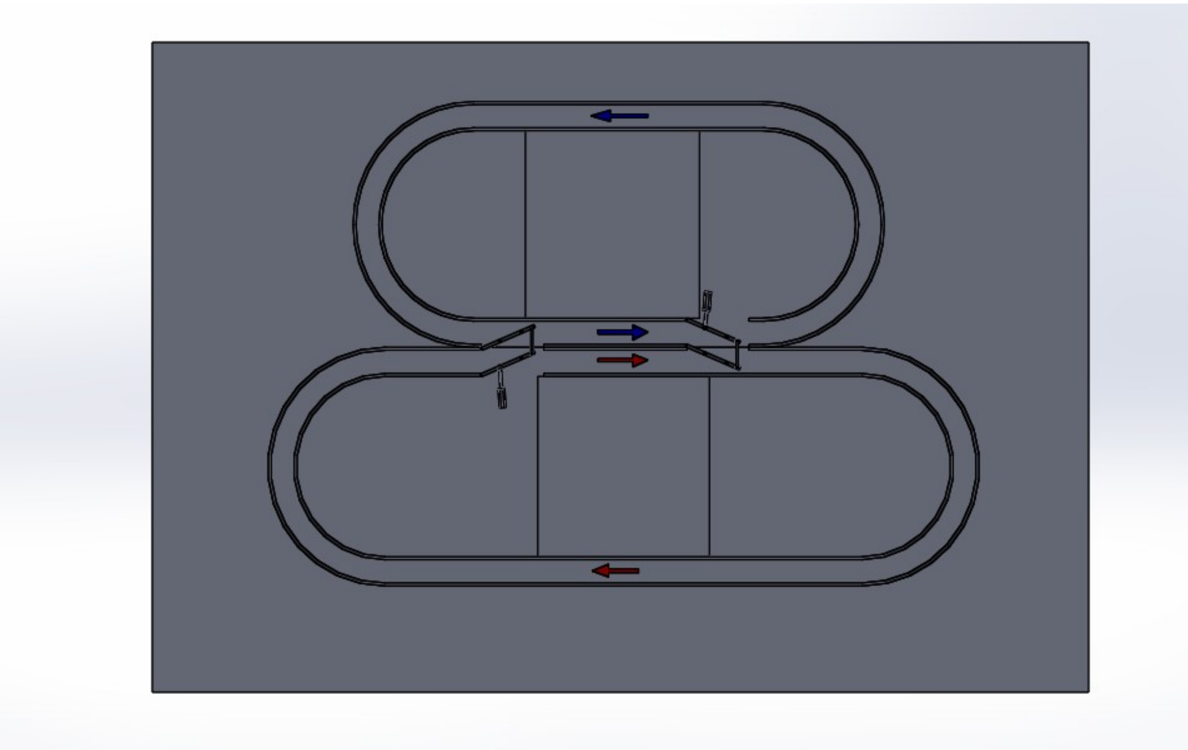


Figure 6: Design of Project

There are two conveyor drawing unit in the figure. These conveyors are connected with two gate. This gate mission is continue to maintaining the product transition with pneumatic system which is connected to RFID system.

This desing has two pneumatic and RFID system components.

3.2 Design calculation and solution of Pneumatic Systems:

Symbols:

P: operating pressure (BAR)

F: pressure force (N)

A: area (cm2)

A': area(cm2)

D: pipe internal diameter (mm)

d: rod diameter (mm)

h: strok (mm)

t: completion of stroke time (sn)

V: stroke volume (lt)

v: strok speed (m/sn)

Qth: theoretical output (lt/dk)

Q: actual flow (lt/dk)

K: buckling load (kg)

Fc: The maximum working load (kg)

Sk: free buckling load (cm)

E: elastic modulus (kg/cm2)

J: moment of inertia (cm4)

S: safety factor

1-) Roller Thrust of Force Account

F= PxA (kg)

$A = \pi x D2 \ /4 \ x100 \ (cm2)$

$A = \pi x \ (0.02)2 \ /4x100 = 0.314(cm2)$

For 2 kg part P is 39 bar so;

F= 39x0.0314= 12.2 N

2-) Cylinder Tensile Account

F=PxA'

$A' = \pi \ (D2 - d2) \ /4x100 \ (cm2)$

So to find cylinder tensile account first we need to find A'

$A' = \pi \ [(0.05)2 - (0.02)2] / \ 4x100 = 0{,}0785cm2$

F= 39x0,0785 = 3.0615 N

Where the cylinder tensile account is 3.0615 N.

3-) Buckling Account

$K = \pi \ 2 \ x \ E \ x \ J / \ S2 \ (kg)$

$J = \pi \ x \ d4 \ /64$

E= 172 (for mica sheet glass)

Fc = K/S

So to find buckling account we need to find J first so ;

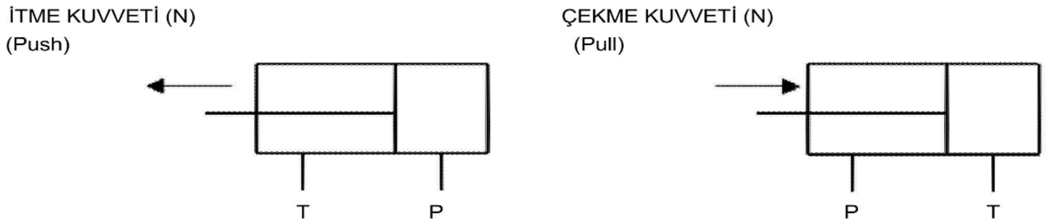
$J = \pi \ x \ (20)4 \ / \ 64 = 7850 \ cm4$

$K = \pi \ 2 \ x \ 172 \ x \ 7850 / \ 25 = 532{,}497 \ kg$

Fc = 532,497 / 25 = 21,299 kg

Maximum load that mica sheet glass that we used is 21.3 kg. This is the basic reason that we prefered mica sheet glass because parts that we use on the conveyors are less than that weight.

Table- 1: Pneumatic related pressure area according to pneumatic size



BORU ÇAPI (TUBE SIZE)	MİL ÇAPI (ROD DIAMETER)	ETKİ YÖNÜ (ACTION)	PİSTON ALANI (PISTON AREA)	ETKİ EDEN BASINÇ ALANI / RELATED PRESSURE AREA (BAR = kg / cm²)							
				1	2	3	4	5	6	7	8
				Kg	Kg	Kg	Kg	Kg	Kg	Kg	Kg
12	6	İtme / (Push)	1,13	1,13	2,26	3,39	4,52	5,64	6,78	7,91	9,04
		Çekme / (Pull)	0,85	0,85	1,7	2,54	3,39	4,24	5,8	5,93	6,78
16	6	İtme / (Push)	2,01	2,01	4,02	6,03	8,04	10,05	12,06	14,07	16,08
		Çekme / (Pull)	1,73	1,73	3,45	5,18	6,91	8,63	10,36	12,09	13,82
20	8	İtme / (Push)	3,14	3,14	6,25	9	12	15	18	21	24
		Çekme / (Pull)	2,64	2,64	5,3	7	10	13	15	18	20
25	10	İtme / (Push)	4,9	4,9	9,8	14	19	24	29	34	38
		Çekme / (Pull)	4,12	4,1	8,2	12	16	20	24	28	32
32	12	İtme / (Push)	8,04	8	16	24	32	40	48	56	64
		Çekme / (Pull)	6,9	7	14	21	27	34	41	48	54
40	16	İtme / (Push)	12,56	12	25	37	50	63	75	88	101
		Çekme / (Pull)	10,55	10	21	31	42	52	63	73	84
50	20	İtme / (Push)	19,62	19	39	59	78	98	118	137	157
		Çekme / (Pull)	16,48	16	33	49	66	82	99	115	132
63	20	İtme / (Push)	31,16	31	62	93	124	156	187	218	249
		Çekme / (Pull)	28,01	28	56	84	112	140	168	196	224
80	25	İtme / (Push)	50,24	50	100	150	201	251	301	351	402
		Çekme / (Pull)	45,33	45	90	136	181	226	272	317	362
100	25	İtme / (Push)	78,5	78	157	235	314	392	471	549	627
		Çekme / (Pull)	73,6	73	147	220	294	368	441	515	589
125	32	İtme / (Push)	122,65	122	245	368	400	613	736	859	980
		Çekme / (Pull)	114,62	114	229	344	485	573	688	802	917
160	45	İtme / (Push)	200,1	200	400,2	600,3	800,4	1000,5	1200,6	1400,7	1600,8
		Çekme / (Pull)	185,06	185	370	555	740	925	1110	1295	1480
200	45	İtme / (Push)	314	314	628	942	1256	1570	1884	2198	2512
		Çekme / (Pull)	298,1	298	596,2	894,3	1192,4	1490,5	1788,6	2086,7	2385
250	50	İtme / (Push)	490,6	490	981	1471,8	1962	2453	2943,6	3434,2	3924
		Çekme / (Pull)	471	471	942	1413	1884	2355	2826	3297	3468

As you can see above the table calculated values for each pneumatic. Used tube size 50 mm rod diameter is 20 mm pneumatic.

3.3 Components of conveyor jack system

Systems occur by union of components. Complex system consist more components and basic systems consist less. To create a system, components should be selected carefully. To select these components design of the system, calculations, specifications of materials, demands of system should be considered as desalination criteria. Conveyor jack system can be considered one of the complex systems. Component selection is based on preliminary design of the conveyor jack. Conveyor jack system contains six main components which pneumatic, Arduino Uno, Raspberry Pi HDMI to VGA Converter, Linear motor, Mica Acrylic Sheet Glass, Pneumatic valves. In this chapter all the components are discussed.

3.4 Conveyor Jack Equipments

3.4.1 Mica Acrylic Sheet Glass

Polystyrene is an artificial polymer. A product which is relatively hard and brittle polystyrene sheet of thermoplastic product family. It softens above 100 ° C, colorless fluid that turns into a liquid state around 185 ° C is transparent. As well as good electrical properties the acid is resistant to oil and alcohols. Polystyrene is an electrical and thermal insulation material and it is used in refrigerators, air conditioners, batteries, chargers etc.

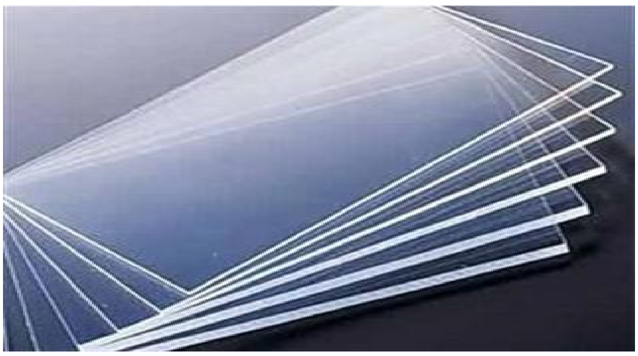


Figure 7: Mica sheet glass

3.4.2 Plastic Stick

It is a stick made by plastic. Plastic stick is used to link each two mica sheet glass on the conveyor.

Figure 8: Plastic Stick

3.4.3 Pneumatic valves

Valve is an output element that opens and closes depending on the condition of plants containing fluid. Usually by the fluid drain out of the system if the fluid pressure of the crucial in the rise of pressure in the system reduces pressure or cutting fluid communication tools are safe in an emergency. Especially as in aircraft hydraulic systems due to a hydraulic system with different controls operated hydraulic systems must also be communicated to the control of the hydraulic pressure which is determined through the valves. According to forms of control valves are divided into three;

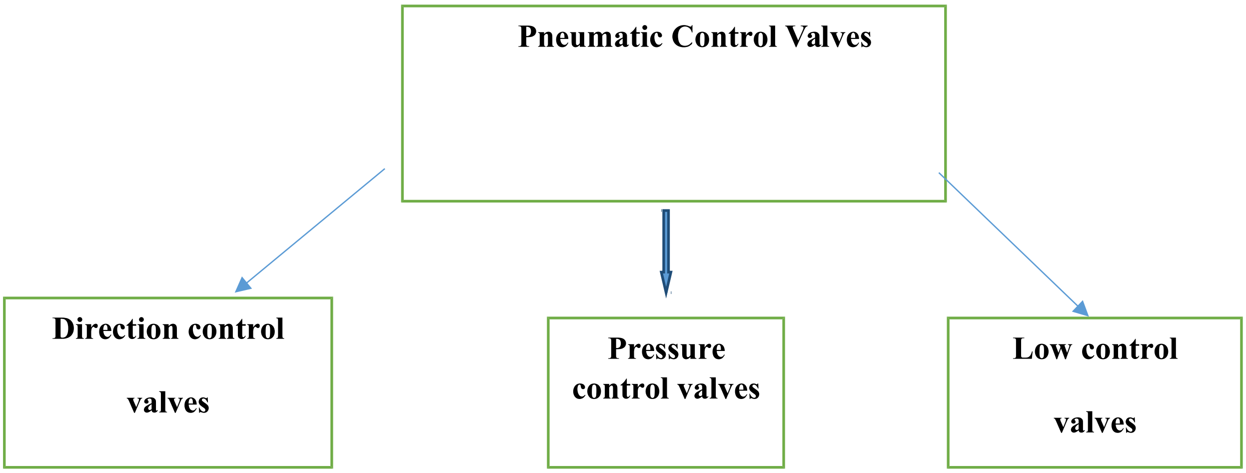


Figure 9: pneumatic valve

3.4.4 Linear Motor

Linear motors are electric induction motors that produce motion in a straight line rather than rotational motion. In a traditional electric motor, the rotor (rotating part) spins inside the stator (static part); in a linear motor, the stator is unwrapped and laid out flat and the "rotor" moves past it in a straight line. Linear motors often use superconducting magnets, which are cooled to low temperatures to reduce power consumption. In a traditional DC electric motor, a central core of tightly wrapped magnetic material (known as the rotor) spins at high speed between the fixed poles of a magnet (known as the stator) when an electric current is applied. In an AC induction motor, electromagnets positioned around the edge of the motor are used to generate a rotating magnetic field in the central space between them. This "induces" (produces) electric currents in a rotor, causing it to spin. In an electric car, DC or AC motors like these are used to drive gears and wheels and convert rotational motion into motion in a straight line.

3.4.5 Pneumatic

Human breathe is taken a small volume from the atmosphere by applying a force filled with air, compressed air. When inflate the balloon or a bicycle tire pump air every time, it is compressed air. Many of the inflated tire or balloon is not easy, it requires lots of muscle power. When compressed air in the balloon or tires, then air will strive to get out. For most of the small volume of filling the force store energy, it is able to just such a job. If the balloon is released, it will return in the room because of the stored energy. This stored energy, the balloon is moving to do business in this way. In any system work with compressed air and then stored energy, called pneumatic system.

Have a variety of advantages over electric and hydraulic systems, pneumatic systems

has increased the demand for these systems. In pneumatic systems provided basic energy production and transmission with air. Air; readily available everywhere, transmission simple, when pressurized is a fluid which can be stored easily. It also does not show a sensitive behavior to temperature changes in use of high temperatures, because of this reason pneumatic systems are more useful and easier than other systems. Using air as the power source is safe. Flash, explosion or combustion does not happen when air using. Another security element in the pneumatic system overload presence in the system is self-stopping. When the overload factor disappears study continue to work again.

In industry, the atmospheric air, engine and compressor called translated is compressed with a special pump. The compressor, the strength of the air chamber fills name a high storage tank. The engine used to power energy made it work. Most of this energy is on the compressor and the energy is stored as compressed air reservoir. So useful was owned energy tanks full of work to do.

Environmental awareness is growing day by day in industrial plants. Regarding this problem, learn when air; and to lay waste to leak or leaks in the lines, even though the environment pollution should be considered as a clean power source in terms of.

Pneumatic systems, has an important place in the development of industrial life. Pneumatic control system can be controlled by the PLC and PC and has the ability to integrate electrical circuits. Installation of pneumatic systems are easy. Pneumatic components are more lightweight, relatively inexpensive maintenance and low cost and effortless than the hydraulic system. Another reason for the choice of pneumatic systems of compressed air systems are to reach high speeds. In addition, the pneumatic linear, circular and angular movement can be easily achieved by mechanical systems.

Figure 12: Pneumatic system

Table - 2 Comparison of the pneumatic system with other systems

	Pneumatic	**Hydraulic**	**Electrical**
viscosity	little or no	high	none
fluid velocity	50–100 m/sn	4–6 m/sn	300.000 km/sn
roller speed	1–2 m/sn	0.2 m/sn	-
availability store	High	little	little
return	**yes**	**yes**	no
energy carriers	air	oil	electron
force transmitted	3,000 kg to low	10.000 Kg great	1200 Kg great
Operating Conditions	clean	dirty	clean
Operating Pressure (special applications except)	6~8 Bar	5~700 Bar	110V~380V
energy transport distance	1000m	100m	endless

3.5 Cost Analysis

In this chapter, the cost analys of pneumatic system is calculated. The costs are listed in the table below.

Table - 3: Cost Analysis

Component	Quantity	Unit Price(TL)	Cost(TL)
Pneumatic	2	120	240
Hinge	4	1,25	5
Screw	50	0,30	15
Mica Acrylic Sheet Glass	4	3,75	15
Arduino Card	1	35	35
Pneumatic Valve	2	40	80

Total Cost = 390 TL

CHAPTER 4

MANUFACTURING, ASSEMBLY and TESTING

4.1 Manufacturing

Nine holes are opened by the drilling machine on the each four mica acrylic sheet glass. Every three holes which are drilled on the mica sheet glass have different functions. First three holes’s aim is to fixed the mica sheet glass on the conveyor. Second three holes’s aim is to work with pneumatic system to provide the movement of mica sheet glass. Third three holes’s aim is to supply a movement of the two mica sheet glasses in the same direction.

4.2 Assembly

48 screw is used on this project. Size of each screw is 3. 5 x 16mm. Every holes on the mica sheet glasses are screwed by the hinge. Two holes are drilled with the drilling machine on each two conveyors. Two mica sheet glasses are fixed on the conveyor with screw and nult. After that other two mica sheet glasses welded, opposite of two mica sheet glasses which is screwed before. Pneumatic is connected with mica sheet which is screwed on the conveyor. Pneumatics are connected in hydrolic valves. In this way pneumatic is like a gate between two conveyors. These gates mean it makes the different material transmission. Plastic stick is put on two micas. Provides the motion of micas on conveyor so the parts can be transmit.

4.3 Testing

In testing, according to observation, if applied force on pneumatic system is too much, gates can get damage. This damage might be loosen up the joints and if this problem occurs again products can not transfer to each conveyor. Therefore pneumatic air pressure should be set sensitively and carefully. Also mica glass can break when the pneumatic air pressure is too much. If the construction of micas are too high on the conveyors, the part which is coming on conveyor can not pass to the other conveyor so it may be a major problem.

4.4 Operation plan

Every junction is equipped with an RFID reader and a controller with access to status information of whole system. The controller evaluates the first digit of part schedule which is stored in memory of part. This digit is the “work order” which requires finding first “accessible service” for corresponding order. If the accessible service is located in conveyor one, and part is coming from conveyor two, junction-2 will shift the part with pallet to conveyor one. If the accessible service is located in conveyor tow, and part is coming from conveyor one, junction-1 will shift the part with pallet to conveyor two.

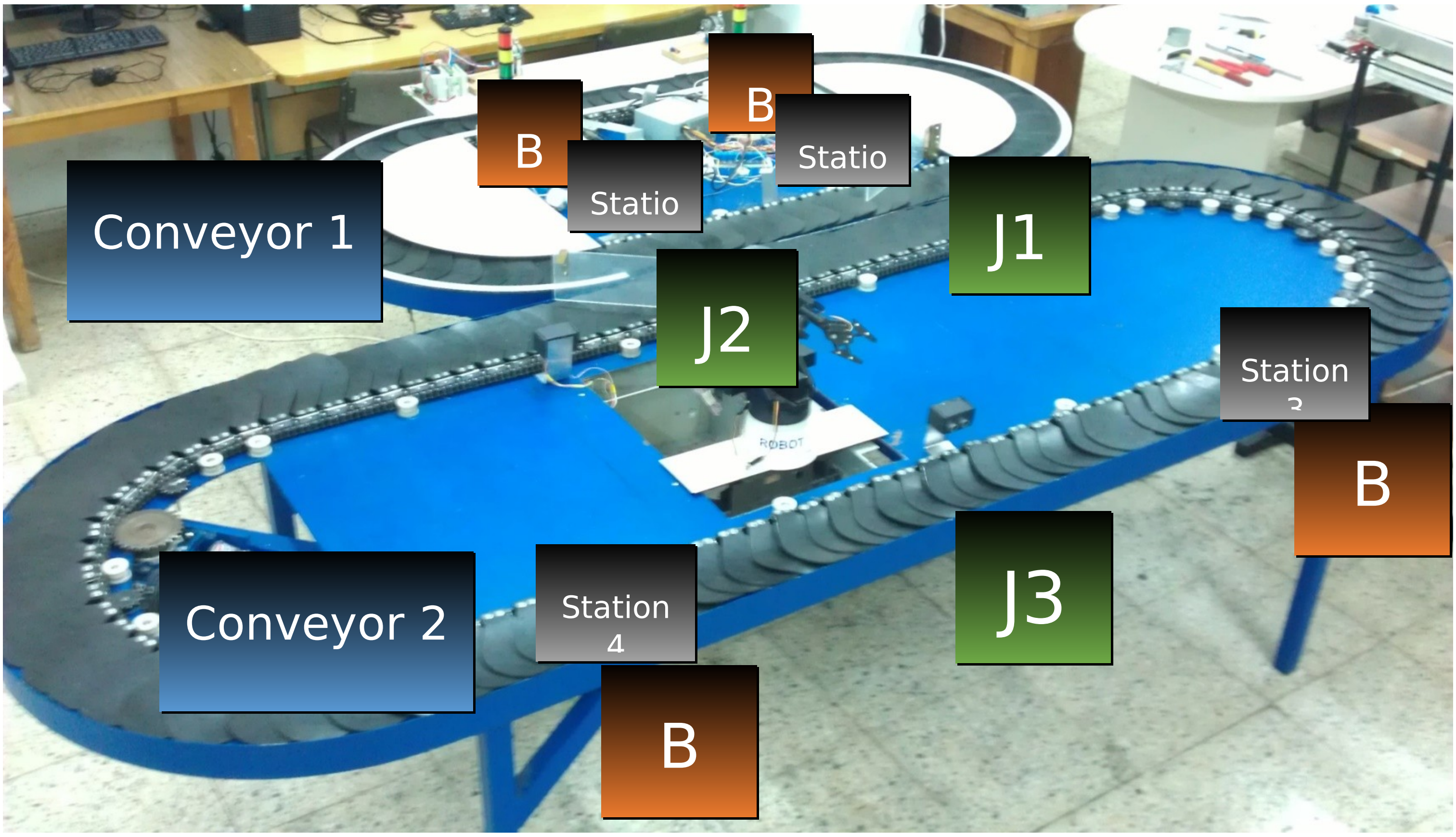


Figure 13: Implementation

CHAPTER 5

RESULTS AND DISCUSSION

Gates provide the connection between two conveyor, these gates working with pneumatic system. These gates aims are continue to production line without stopping, store diffrent products right place and prevent to loss time. The most important task responsibility to the gates of the connection between this conveyor system, because these gates open time is very important of the production line.

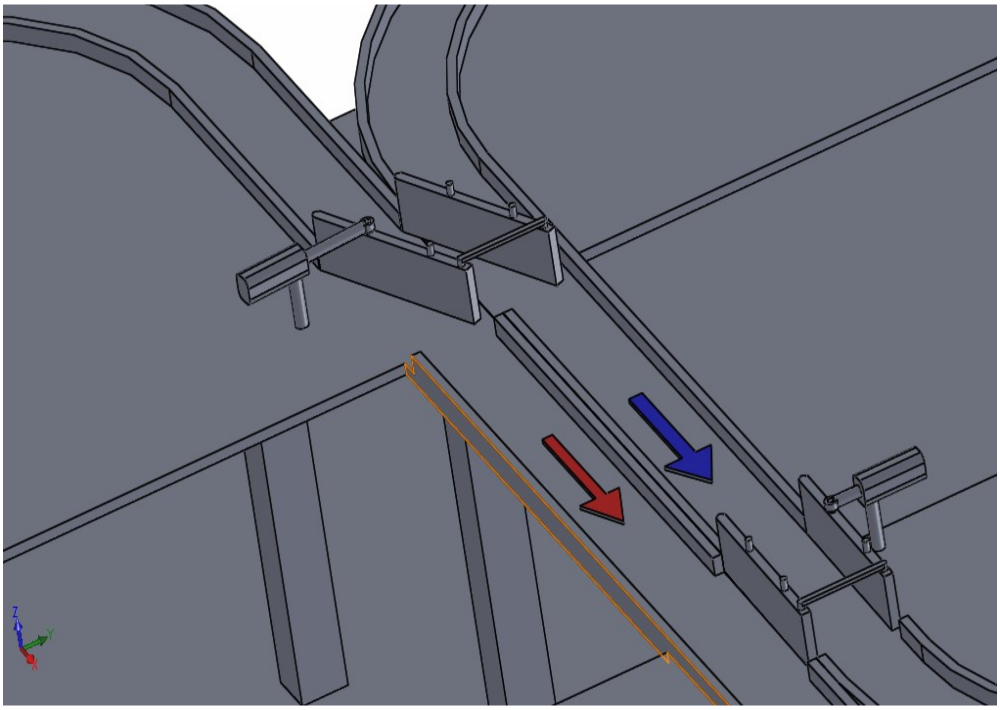


Figure 14: Gate one open form

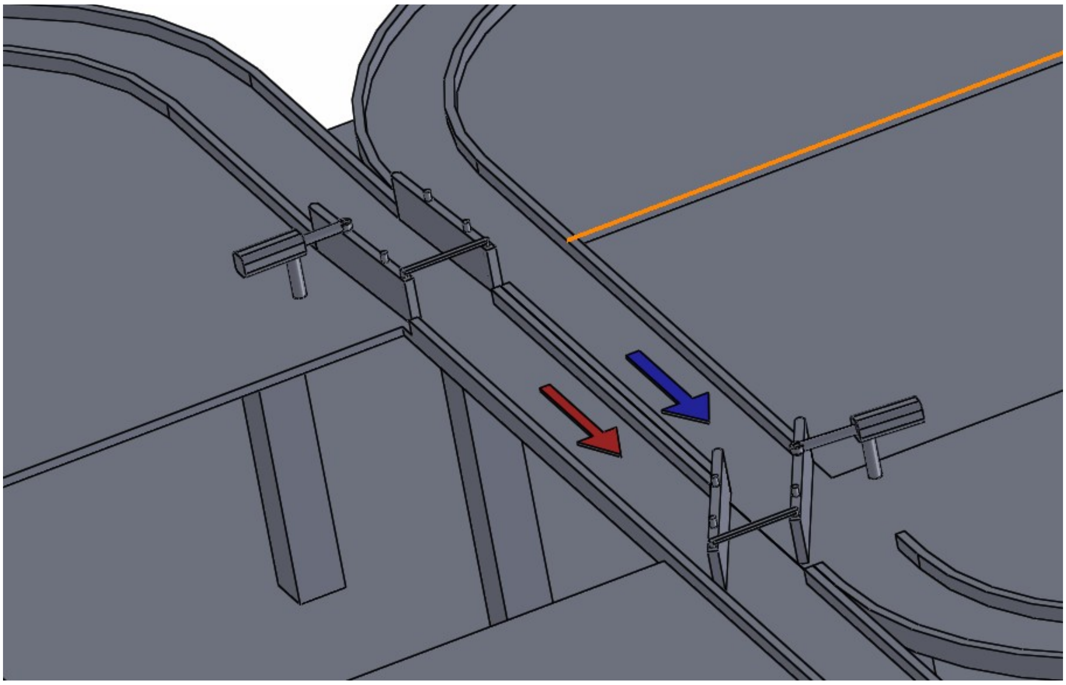


Figure 15: Gate two open form

Products with the return on the conveyor, using one of the two gate according to the intensity of the conveyor. In this way, reduce the product intensity. RFID is also working in conjunction gate systematic. For the operation of this system, add barcodes on products. These products barcodes read with RFID system and decided to transfer which gate using each different products, so diffrent products can store separately each other on the same conveyor. Therefore each product should have different barcode. Products can separate with shape and colour for his system.

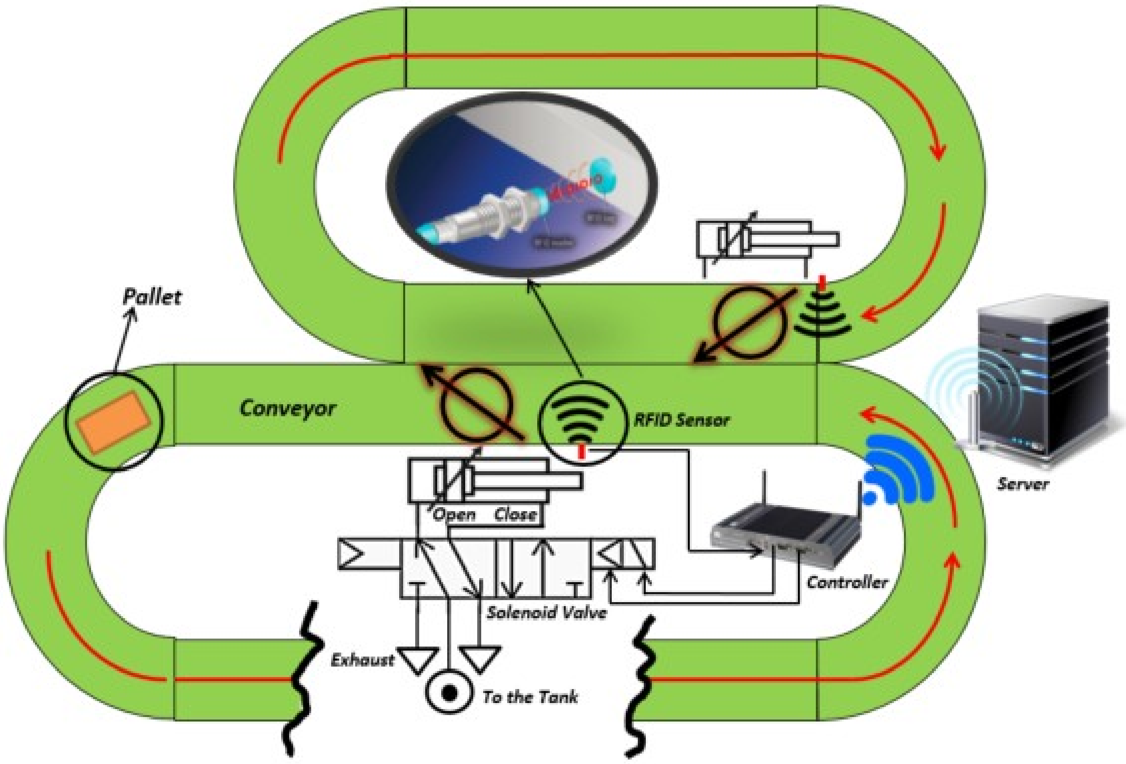


Figure 16: Shematic model of part difrentiation with RFID

A proximity sensor detects the presence of a piece of metal and knows that a pallet has arrived at that location. Likewise, an RFID system also detects the arrival of a pallet. Except an RFID system can also determine what type of part is on that pallet by reading the identification code programmed into the tag. This does not mean to suggest RFID beats proximity sensors for all possible applications.

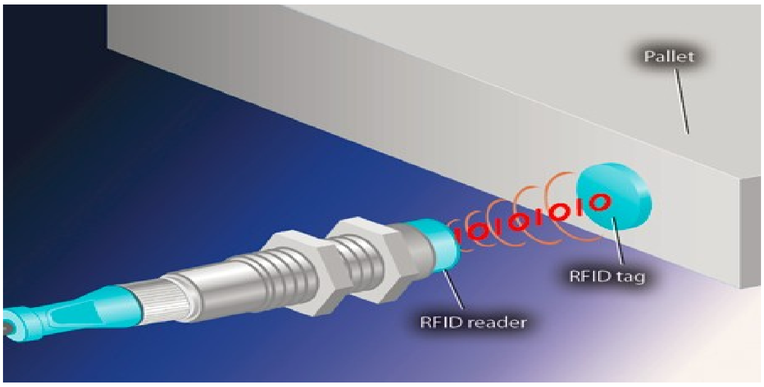


Fıgure 17: RFID system

Applications that use a collection of proximity sensors to read a code block basically a piece of metal with a hole pattern should seriously consider an RFID upgrade. Not only does RFID provide flexibility in the event a system must expand, it also gives more security and reliability.

CHAPTER 6

CONCLUSION AND FUTURE WORKS

This project is a fulfillment for our capstone project course (MENG411). The aim of this Project which was to reduce product density on conveyor using a pneumatic system is achivet. In this report, the project was discussed in details. Then the design process were described in detail (calculation and drawings), followed by the detailed information about the manufacturing process. Experimental results were mentioned and discussed. Also, cost analysis of the project was presented.

Nowadays in the industry requirements of human labor is reducing day by day therefore creative new industry systems have to be developed and pneumatic systems play very important role to achive this purpose. In industry pneumatic systems are using a lot of sector. At the present time almost all of the manufatureres are using flexible systems. Flexible manufaturing enables; high speed manufacturing, easy to storage, different products can be manufactured at the same time.

For future work flexible manufacturing can be support by PLC system. Also conveyor can support with robotic arm. It can be faster than pneumatic systems. Another option is barcode reader can be applied on this system and every product have a barcode and it can storage different products according to their color, shape time. So time can be reduce and production line can work more.

What we have done:

- Junctions one and tow are design and simulated in solid work.

- Junction surfaces are designed with Plexiglas guided with metal joints connected to conveyors.

- Linear pneumatic arms are connected to junctions actuated with solenoid valves.

REFERENCES

[1] Concept of Flexibility, **http://www.sciencedirect.com/science/article/pii/0305048395000542 Retrieved on 12 january, 2015**

[2]Flexible Manuf System, http://en.wikipedia.org/wiki/Flexible_manufacturing_system . **Retrieved on 12 January, 2015**

[3]Characteristic of Manufacturing System, https://www.coursehero.com/tutors-problems/Mechanical-Engineering/6628676-Characteristics-of-Flexible-Manufacturing-Systems-For-many-years-th/. **Retrieved on 13 January, 2015**

[4]Flexibility Type , https://www.albemarle.org/upload/images/forms_center/departments/fire_and_rescue/forms/pft/ACE_Personal_Trainer_Chapter_10.pdf, **Retrieved on 14 January, 2015**

[5]History of the Flexibility system, http://www.ukessays.com/essays/information-technology/a-history-of-flexible-manufacturing-systems-information-technology-essay.php, **Retrieved on 15 January, 2015**

[6]Classification Flexibility type, http://rudradevelopers.co.in/sand_making_Beneficiation/classification-conveyor-belt.html, **Retrieved on 15 January, 2015**

[7]Belt Conveyors, http://www.beumergroup.com/products/conveying-technology/belt-conveyor/, **Retrieved on 16 January, 2015**

[8]Chain Conveyors, http://www.redler.com/en/products/conveyors-eleveyors/, **Retrieved on 16 January, 2015**

[9]Improcement of conveyor jack, http://www.lewcoinc.com/conveyors/news/improvements-to-lewco-cdlr,-chain-driven-live-roller-conveyors.aspx, **Retrieved on 17 January, 2015**

[10]Previous Studies of Conveyner jack, https://www.worksafe.qld.gov.au/__data/assets/pdf_file/0011/82937/perform-case-study-sun-metals-belt-conveyors.pdf**, Retrieved on 17 January, 2015**

[11]Components of Conveyor Jack System, http://www.ielm.ust.hk/dfaculty/ajay/courses/ieem513/MH/MHsys.html**, Retrieved on 17 January, 2015**

[12]Raspberry pi Case, http://www.bit-tech.net/modding/2013/03/22/raspberry-pi-case-competition-update/1**, Retrieved on 17 January, 2015**

[13] Raspberry pi Case Model B+, http://www.raspberrypi.org/products/model-b-plus/**, Retrieved on 18 January, 2015**

[14] Raspberry pi HDMI and VGA convertor, https://www.modmypi.com/pi-vew-raspberry-pi-hdmi-to-vga-converter**, Retrieved on 19 January, 2015**

[15] Arduino uno card, http://arduino.cc/en/Main/arduinoBoardUno**, Retrieved on 19 January, 2015**

APPENDIX A

LOGBOOK

OF

ÖMER OĞUZ KESER

Dates	Details
06/04/2015	We start preparing Gant Chart for capstone 2 with my friends Çağlar and Onurcan
17/04/2015	Capstone group member meeting. Planning work sharing
24/04/2015	I did some research about pneumatic system on internet
27/04/2015	I start writing abstract again
02/05/2015	We went Poorya's office to get some information about capstone design
05/05/2015	I went to workshop to see conveyor and did some measurement there
19/05/2015	We went to see Poorya and he gave material names which we had to buy from outside of the school
21/05/2015	We gave an order pneumatic material from Istanbul
25/05/2015	We start writing organization of report
29/05/2015	We got our parts and had a chance to test it
02/06/2015	I went to workshop to for drilling the mica sheet
05/06/2015	Asking Prof. Dr. MajidHashemipour about design
10/06/2015	We put mica sheet on the conveyor
12/06/2015	I made grinding on the edge of conveyor
14/06/2015	I made welding to connect 2 mica sheets
16/06/2015	We put pneumatic on conveyor
18/06/2015	We tested our part
19/06/2015	Finishing the capstone report

LOGBOOK

OF

YUSUF ÇAĞLAR ÖZBEK

Dates	Details
06/04/2015	We start preparing Gant Chart for capstone 2 with my friends Oğuz and Onurcan
17/04/2015	Capstone group member meeting. Planning work sharing
23/04/2015	I visited Prof. Dr. MajidHashemipour to ask about capstone report structure
28/04/2015	I start writing introduction for capstone project
02/05/2015	We went Poorya's office to get some information about capstone design
06/05/2015	I start writing the literature review.
19/05/2015	We went to see Poorya and he gave material names which we had to buy from outside of the school
21/05/2015	We gave an order pneumatic material from Istanbul
25/05/2015	We start writing organization of report
29/05/2015	We got our parts and had a chance to test it
03/06/2015	I start drawing our capstone project
05/06/2015	Asking Prof. Dr. MajidHashemipour about design
11/06/2015	Finishing the drawings
13/06/2015	Writing log book
14/06/2015	I put the drawings on the report
16/06/2015	We put pneumatic on conveyor
18/06/2015	We tested our part
19/06/2015	Finishing the capstone report

LOGBOOK

OF

ONURCAN ONUR

Dates	Details
06/04/2015	We start preparing Gant Chart for capstone 2 with my friends Oğuz and Onurcan
17/04/2015	Capstone group member meeting. Planning work sharing
23/04/2015	I visited Prof. Dr. MajidHashemipour to ask about calculations for capstone project
28/04/2015	I start writing new developments on pneumatic systems on the report
02/05/2015	We went Poorya's office to get some information about capstone design
09/05/2015	I made some research about pneumatic systems
19/05/2015	We went to see Poorya and he gave material names which we had to buy from outside of the school
21/05/2015	We gave an order pneumatic material from Istanbul
25/05/2015	We start writing organization of report
29/05/2015	We got our parts and had a chance to test it
03/06/2015	I start doing calculations
05/06/2015	Asking Prof. Dr. MajidHashemipour about structure of the report
11/06/2015	Finishing calculations

13/06/2015	Writing log book
14/06/2015	I put calculations on report
16/06/2015	I wrote assembly, manufacturing and data on the report
18/06/2015	We tested our part
19/06/2015	Finishing the capstone report

APPENDIX B

APPENDIX C

DRAWINGS

APPENDIX D

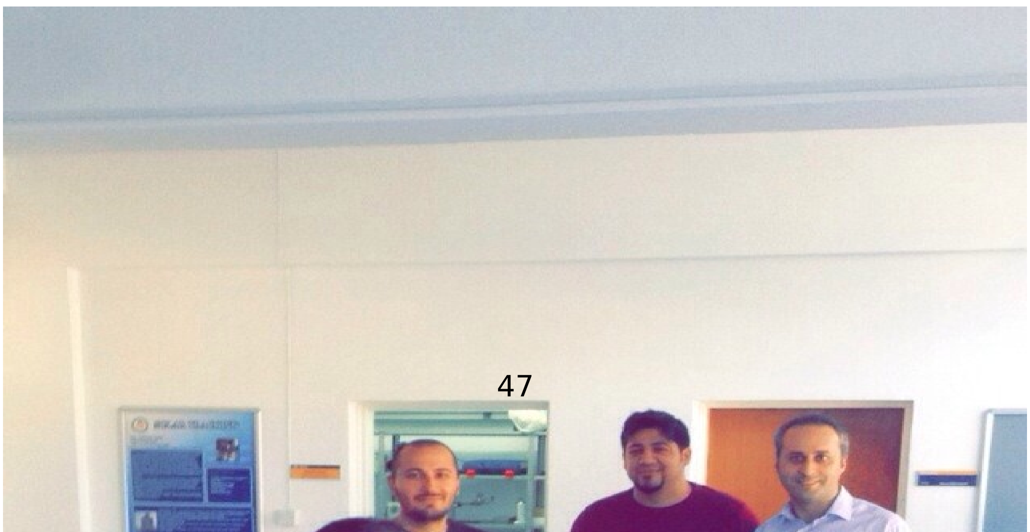


Figure 18: Assembly-1

Figure 19: Assembly-2

Figure 20: Assembly-3